

New Frontiers in the Empirical Research on Informal Contracting

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Abstract

In a standard model of informal contracting (MacLeod and Malcomson 1989; Levin 2003), parties know the value of their relationship and can use discretionary payments to split it. As a result, efficient contracts are stable over time. Recent models have relaxed these simplifying assumptions, shedding light on how informal contracts are built over time, how they are subject to path dependency, and how relational rents are created. In this paper, we investigate how these “non-standard” theories of informal contracts can be tested empirically. We begin by discussing predictions from a selection of representative models, and the strategies that can be adopted to test them. Then, we examine how, and to what extent, existing empirical evidence supports these predictions, as well as how available data may be used for further testing.

Keywords: Informal contracts, Enforcement, Empirical evidence, Testability.

JEL codes: D23, L24, M21.

1. Introduction

At least since Macauley (1963), economists, sociologists and legal scholars alike have documented the pervasiveness of *informal contracts*—that is, contracts enforced by the threat of terminating valuable relationships, rather than by courts. Building on this fundamental insight, economists have developed a standard principal-agent framework for analyzing informal contracts, which we refer to as the “standard model” (e.g., MacLeod and Malcomson 1989; Baker *et al.* 1994, 2002; Levin 2003; Malcomson 2013). This framework has generated a number of predictions on the determinants of informal contracting, and on how informal and formal contracts interact with one another, spinning a small but growing body of empirical evidence (see Gil and Zanmarone 2015).¹

While undoubtedly valuable, the standard model is based on some strong simplifying assumptions, among which particularly important are, (1) symmetric information about the value of relationships, and (2) unconstrained discretionary payments that can be used to share the long-term rents from cooperation. Because of these assumptions, the standard model predicts that optimal informal contracts are stationary (i.e., they do not change over time, conditional on the state of nature), and thus it cannot explain how contractual relationships are built and gradually evolve, and how their evolution may be subject to path dependency (e.g., Gibbons and Henderson 2012, 2013; Helper and Henderson 2014).

¹ In a companion paper, Gil and Zanmarone (2015) review empirical strategies and opportunities in the existing empirical literature that tests implications of the standard informal contracting model. Our analysis here extends and complements that paper in that we discuss the empirical testability of theoretical predictions that require modifying or removing some of the assumptions in the standard informal contracting model.

An important part of the new theoretical frontier on informal contracts is to relax simplifying assumptions (1) and (2) in the standard model, and develop “non-standard” theories that can explain the patterns discussed above. For instance, MacLeod (2003), (the last part of) Levin (2003), and Fuchs (2007), analyze models of subjective performance evaluation where the agent’s output is privately observed by the principal, providing important insights on the use of efficiency wage contracts backed by the threat of termination, and on the timing of performance reviews by the principal. Chassang (2010) sheds light on routine building and path dependency in informal relationships studying a model where parties in an informal contract have private information on each other’s payoff functions, and hence on the optimal definition of cooperation. Similarly, Halac (2012), which is discussed in greater detail below, explores the consequences of asymmetric information (in her case, on the parties’ outside options) for the dynamic evolution of performance bonuses in relational incentive contracts. Finally, Li and Matouschek (2013) show how asymmetric information on an employer’s ability to pay his employee due to contingent cash constraints results in employment relationships characterized by permanent cycles of high and low cooperation.

Regarding the unlimited liability assumption in the standard model, a number of recent papers have relaxed it in a diverse number of settings such as the choice between loyal and new partners in supply networks (Board 2011, discussed below), the dynamic patterns of knowledge transfers in apprenticeships (Garicano and Rayo 2013), the cycles of cooperation within firms (Fong and Li 2015), the distribution of new technologies in

developing economies (Fuchs et al. 2015), and the path dependency of informal delegation of authority in organizations (Li et al. 2014).²

While a body of empirical evidence on the standard model of informal contracting is slowly emerging, as mentioned before and as discussed in our companion paper (Gil and Zanarone 2015), there is no evidence to date on the non-standard models described above. In this paper, we aim to encourage the development of such an empirical research frontier, by providing a methodological framework for testing the emerging “non-standard” models of informal contracting.

The article is organized as follows. Section 2 summarizes the theoretical predictions from selected models of informal contracting that relax assumptions (1) and (2) in the standard model. Section 3 discusses the data necessary to test those predictions, as well as potential empirical strategies. Section 4 discusses the testability of other recent models of informal contracting that further depart from the standard model, and section 5 concludes.

2. Theoretical predictions

Because the theoretical literature is still at its outset, there is no unified non-standard model from which to derive general testable predictions. Hence, we will follow a “heuristic” approach—that is, we will discuss two representative non-standard models (Board, 2011; and Halac, 2012) and how to test them, hoping that interested researchers will use our framework as a starting point to push the frontier further. We choose these papers over others not because we believe they are qualitatively superior, but because

² See Ray (2002) for a more general model of informal contracting with limited liability and for references to earlier studies.

besides being published in top journals in economics, they seem especially well-fitted for empirical exploration. In particular, and as discussed in greater detail below, both papers offer relatively simple comparative static predictions that should impose manageable data collection burdens on empirical researchers. Therefore, they seem a reasonable starting point to discuss the testability of non-standard informal contracting models. In the final section of the paper, we will briefly discuss the testability of non-standard models other than Halac (2012) and Board (2011).

2.1. Informal contracts under incomplete information: the Halac model

Halac (2012) relaxes assumption (1) above in the standard model—namely, symmetric information—and studies informal incentive contracts in settings where the agent does not know how much the principal values her future relationship with him. Let principals who do and do not value the relationship be “high commitment” and “low commitment” types, respectively. Compared to those of low commitment types, the profits of high commitment principals are more heavily reduced if their relationship with the agent terminates—for instance, because the agent possesses human capital that is specific to them, or because they have less time to search for replacements. Hence, upon observing satisfactory agent’s performance, high commitment principals can credibly promise to pay him a larger informal incentive bonus, because they know the agent can more severely punish them by threatening to terminate the relationship.

A key result in Halac (2012) is that in general, the agent cannot infer whether the principal is a high commitment or low commitment type based on the incentive contract the principal negotiates with her at the beginning of the relationship. In particular, and in stark contrast to the standard case of complete information, the agent cannot infer that a

principal who offers a large incentive bonus values the relationship, and hence can credibly commit to pay. To understand the intuition behind this result, suppose the agent is offered a large informal bonus and, based on that, she believes the principal to be a high commitment type. Since the agent trusts the principal to pay, she responds to the bonus scheme by exerting high effort. Then, a low commitment principal would have a strong incentive to offer the same high-powered incentive contract, as that would allow him to gain from the agent's high effort, and then cut her off-guard by renegeing on the promised bonus.

Building on this insight, Halac (2012) goes on to show that both the initial incentive contract, and its evolution in the course of the relationship, importantly changes depending on whether the principal or the agent has bargaining power. We elaborate on this point below.

Case 1: the principal has bargaining power

This will be the case, for instance, if the agent does not belong to a union. Since the principal cannot signal his commitment level ex ante, through the size of the offered bonus, the agent can only detect low commitment principals through ex post signaling—that is, when the principal reneges on the promised bonus payments. As a consequence, all principals offer the same incentive contract, and the baseline bonus payment (that is, the first period bonus) is high-powered if the agent holds a strong prior belief that the principal is a high commitment type, in which case the risk of default is limited, whereas it is low-powered otherwise.

Regarding the relationship's dynamics, if the agent believes the principal to have high commitment, the optimal incentive contract is designed in such a way that the promised bonus payments and the agent's effort, but also the probability of default by the principal, increase over time, as the agent grows more and more convinced about the principal's commitment. In contrast, when the agent believes the principal to have low commitment, the optimal incentive contract is stationary, and it is characterized by low bonus payments, low effort, and no defaults, in every period.

Case 2: the agent has bargaining power

This case may be relevant, for instance, if the agent belongs to a (strong) union, or if she has political support. Halac (2012) shows that, in this case, the agent can infer the principal's commitment level *ex ante*, through screening. Under screening, the agent demands a high-powered incentive contract, characterized by identically large payments and effort requirements in each period, and designed in such a way that if the principal honors the contract, his discounted stream of profits equals his outside option. While a high commitment principal accepts (and honors) the proposed contract, a low commitment principal prefers to reject it, because he knows that if he accepted the agent's offer he would subsequently renege on the promised payment, so the relationship would prematurely terminate, and hence his expected stream of profits would not compensate the outside option. Once the low commitment principal reveals himself by rejecting the proposed contract, there is one period of "strike", without production, after which the agent negotiates with the principal a low-powered incentive contract, compatible with his limited commitment ability, from the next period and thereafter.

Halac (2012) also shows that, since screening is potentially costly (due to the period of strike), it is only optimal if the agent's prior belief that the principal has high commitment, and hence will accept the contract, is strong. If that is not the case, the agent prefers to offer a low-powered incentive contract that both principal types are willing to accept.

Summary of testable predictions

From the results discussed above, a number of potentially testable predictions can be obtained. First, at the beginning of a contractual relationship, bonuses in an informal incentive contract should be higher, relative to those in an optimal formal contract, when the agent has a strong prior belief that the principal values the relationship, and hence is able to commit.

Second, the likelihood of defaults on informal bonuses by the principal should increase in the agent's prior belief when the principal has bargaining power, but not when the agent has bargaining power, as in the latter case ex ante screening insures that there are no defaults in equilibrium.

Finally, informal bonus payments, and the probability of default, should be increasing over time when the principal (the informed party) has bargaining power, and non-increasing over time when the agent has bargaining power. This last prediction depends on the fact that when the agent has bargaining power, the probability of default is equal to zero. Moreover, bonus payments do not change over time if the agent's prior assessment of the principal's commitment is low, or if the agent's prior is high and it turns out to be correct ex post. Finally, if the agent's prior assessment is high but the principal turns out

to have low commitment, bonus payments are high in the first period, and drop to a low level from the second period onwards.

2.2. Informal contracts under liquidity constraints: the Board model

Board (2011) relaxes assumption (2) in the standard model—namely, the absence of liquidity constraints—and studies informal contracts between a principal and multiple agents.

In his baseline application, the principal is a buyer, and the agents are suppliers who may hold up the buyer's specific investments. The suppliers' actions and the relationships' outcomes are non-verifiable, so holdup can only be prevented by resorting to informal contracts sustained by repeated interactions. In any given period, the buyer observes the cost of investing in each available supplier, after which he decides on which supplier to invest. Board (2011) assumes the suppliers are cash-constrained, so the buyer cannot make them residual claimants while extracting the relationship's value via upfront fees. As a result, optimal informal contracts must grant long-term quasi-rents to the suppliers, so that when a given supplier is used, he will not be tempted to hold up the buyer for fear of losing those rents.

When starting his business, the buyer informally announces his choice of suppliers for all future periods, contingent on the realized costs. Absent liquidity constraints, the buyer would extract the full surplus from each supply relationship, so he would allocate suppliers efficiently by investing in the lowest-cost supplier in each period. Since suppliers are cash-constrained, though, the buyer reckons that every time he switches to a new supplier he needs to pay him a stream of quasi-rents to prevent hold up. As a result,

the buyer is biased against new suppliers, in the sense that he may prefer to rely on the existing suppliers, or “insiders”, even in periods where new suppliers, or “outsiders”, are less costly, in order to save on quasi-rents. Board (2011) calls this inefficient reliance on insider suppliers “loyalty”.

Summary of testable predictions

As discussed by Board (2011), the broad prediction that optimal contracts exhibit loyalty to insiders is consistent not only with his informal contracting model, but also with models where there are exogenous costs of switching suppliers—for instance, training of the new supplier’s employees. However, in an exogenous switching cost model with complete information, the degree of loyalty should not depend on whether the contract between buyer and suppliers is formal or informal (if the buyer’s information on suppliers were incomplete, this may no longer be true because a “bad” outside supplier would have more opportunities to renege on an informal contract than on a formal one, and so he would be more risky than an insider for the buyer). Moreover, in an exogenous switching cost model where loyalty is not part of an informal agreement between suppliers and the buyer, a supplier’s performance should not depend on whether the buyer is loyal to her (in the sense that he assigns her more business than to outsiders).

Based on these observations, a number of potentially testable predictions can be obtained from Board’s model. First, a buyer’s loyalty to its suppliers should increase in countries characterized by lower court quality, where contracts tend to be informal.

Second, if a buyer stops being loyal to his current suppliers and switches to outsiders, the insiders should decrease the quality of their performance in future interactions with the buyer.

Third, buyers who decide to become disloyal and switch to new suppliers should use more formal contracts in their future dealings with inside suppliers, as they can no longer rely on informal agreements to prevent holdup.

Finally, a buyer's loyalty to his suppliers should increase when the expected duration of the relationship is short—that is, when the common discount factor of buyer and suppliers decreases. The reason for this last prediction is that, as the discount factor decreases, the stream of quasi-rents that the buyer must grant his suppliers to prevent holdup increases, and so does the cost of switching to outside suppliers.

3. Testability

3.1. Potential empirical tests of Halac (2012)

In order to test the predictions from Halac (2012), one needs to measure at least four variables: (i) the incentive bonus offered at the beginning of an informal principal-agent relationship; (ii) the evolution of informally contracted bonus payments in the course of the relationship; (iii) the allocation of bargaining power between the principal (a company, a manager, a buyer) and the agent (a CEO, a worker, a seller); and (iv) the agent's prior beliefs regarding the principal's type (low or high commitment type in the model). Once measures for these variables are available, one can test the predictions of Halac's model on how information and bargaining power affect the terms and dynamic evolution of informal incentive contracts. Although Halac argues that her analysis is

applicable to a broad number of scenarios such as “*employment contracts, inter-firm agreements, supply-chain relationships, informal credit contracts, and other settings where contracting tends to be informal and information is typically incomplete*”, we will primarily focus here on a few well-known data sets on employment and procurement contracts. At the end of this section, we will also propose a new empirical setting—namely, incentive contracts in academia—that seems to fit the mechanisms described in Halac (2012), and hence may be used to test the predictions from her model.

Data

Since assessing the empirical validity of the predictions from Halac (2012) requires following the principal-agent relationship over time, we may need longitudinal data on informal incentive payments starting from the beginning of a contractual relationship, as well as across relationships that vary in their distribution of bargaining power and degree of informational asymmetry. Collecting data on whether incentive payments are formal or informal is challenging but possible, as demonstrated by existing studies of employment contracts (Gillan et al. 2009) and inter-firm distribution agreements (Gil 2013). The agent’s beliefs about the type of the principal can be assessed by looking at whether the agent has some knowledge of the principal’s history and reputation—perhaps through public rankings such as Fortune’s “Best Companies to Work For” index—or has specific expertise to judge the principal’s type—for instance, because he has been an employee or frequent business partner of the principal in the past. Finally, variables that measure the bargaining power of the agent would be the degree of unionization of labor force in a company or location, and whether the principal is a monopsonist (e.g., sole employer for all workers) in the local labor market.

If payment data are available but it is not possible to establish whether they are informal, an indirect test could be developed by looking at whether the patterns predicted by Halac (2012) are stronger in settings where courts are weak, and hence contracts (even if formal) can be presumed to be informally enforced. Measures for the availability of court enforcement across countries are proposed, among others, by Johnson *et al.* (2002), and Antras and Foley (2014).

Empirical strategies

A test of Halac's (2012) predictions on the effect of the agent's information and bargaining power on the initial size and dynamics of informal incentives could be performed in the context of executive compensation by combining the empirical strategies of Gillan *et al.* (2009) and Devaro *et al.* (2015). Gillan *et al.* (2009) study the choice between explicit and implicit employment agreements (EAs) for CEOs in S&P 500 firms. The interesting feature of their data is that it exploits a property of the legal environment—namely, the obligation to disclose all formal dimensions of CEO employment agreements to the SEC—to measure whether the compensation terms in such agreements are formal (if disclosed) or informal (if not disclosed). Aside from these data, Devaro *et al.* (2015) have the complementary, longitudinal information on the size of CEOs' bonuses year by year, which is necessary to test Halac's predictions on the dynamics of informal incentives. As suggested by Gillan *et al.* (2009), the beliefs of the agent about the principal's type can be measured in this context by looking at whether the CEO has been promoted from inside the company or has been hired from another company in the same industry. An outside CEO should be less informed about the company's past bonus practices, and hence, controlling for observable characteristics of

the company, should be more uncertain about the company's trustworthiness. Moreover, the bargaining power of CEOs can be measured by proxies for their outside options, such as the number of other companies in the same industry.

In a procurement context, Ahmadjian and Oxley (2006, 2013) examine the relationships between buyers and input suppliers in Japanese conglomerates (*Keiretsu*). In these networks, buyers and suppliers usually own each other's stocks and participate in each other's governance through membership in the board of directors and shareholder meetings. Whether stock cross-ownership exists (and the degree of buyer's stock owned by the supplier) may be a good proxy for the supplier's (agent) prior belief that the buyer (principal) is a good, relational type. Their data set also specifies how dependent each supplier is on the buyer's purchases, and vice versa, which may be a good proxy for bargaining power. Similar measurements could be obtained from the European survey data used by Johnson et al. (2002) and, more recently, Calzolari et al. (2014). The two major drawbacks in those data (relative to the Ahmadjian and Oxley's papers) are that stock cross-ownership is less common in Europe than in Japan, and that survey data may abuse the subjectivity of the responses. Notice that none of the aforementioned procurement data sets has information on the size and evolution of incentive payments and on whether those payments are informal, so these data sets need to be augmented in order to test the predictions of Halac (2012).

In traditional franchising networks, such as car dealerships, companies can unilaterally determine the maximum sales margins earned by their distributors by changing the wholesale prices and discounts. For instance, as discussed in Zanarone (2009, 2013), dealership contracts give European car manufacturers full discretion to

change the list price of cars, which is the maximum that can be charged to customers, and the discounts awarded to dealers. The higher the expected sales markups in year $t+1$, the stronger a dealer's incentive to invest in innovative marketing campaigns, store maintenance and customer comfort in year t . From this point of view, sales margins can be seen as informal incentive payments. One may then test the predictions from Halac (2012) by collecting longitudinal data on the maximum sales margins, which are typically recorded in annexes to the dealership contract. The dealers' prior beliefs may be approximated by measures of the manufacturer's reputation, such as its position in "best franchise" rankings or the number of years it has been franchising (Arruñada et al. 2001). Bargaining power may be approximated by the manufacturer's market share, by whether the dealer owns multiple stores, or by whether dealers are collectively organized through an association.

Finally, although there are no existing data sets to be exploited, a context where in our opinion Halac (2012) could be tested is academia, particularly economics departments and business schools (our main sources of anecdotal knowledge). In academia, deans and department chairs make decisions in a rather discretionary way on bonuses and salary raises awarded to faculty members contingent on good research and teaching performance, on adjustments to teaching loads and schedules in response to unforeseen events, on tenure decisions, and on future recruitment, positioning, and growth strategies. A new department/school, or one that has decided to change its focus from teaching to research, will advertise itself in the JOEs and attend international job market venues such as the AEA or the Academy of Management meetings. There, the new department will face a lineup of potential candidates who may wonder whether the

department can credibly commit to its promises on discretionary compensation, teaching loads and schedules, tenure requirements, and consistency in recruiting efforts.

Then, a potential way to test Halac's (2012) predictions on the relationship between informal incentives and bargaining power in the academia context is to compare the offers received by candidates from fields that are in higher or lower demand (for instance, finance vs. economics). Similarly, one may test Halac's predictions on how the agent's prior belief about the principal's trustworthiness affects incentives by comparing the offers made by newly created departments from universities with different reputations (for instance, as measured by official rankings), where reputations would proxy for the candidates' belief that their prospective employer is a trustworthy type. A potential issue in conducting this study is data availability. One possible strategy would be to run a large-scale survey. Since most of the information discussed above is fairly objective, response biases would be less of a concern than in other types of surveys. Information on which departments/school began participating to the international academic job market in any given year may be obtained from the archives of the AEA and of corresponding societies in fields other than economics.

Potentially related evidence

As we saw, Halac's (2012) model predicts that incentive bonuses and effort may increase over time when the principal has private information on his own commitment ability. When that is the case, the joint surplus—that is, the expected value of the informal relationship between the principal and the agent—should also increase over time, as the relationship unfolds and the agent updates his belief about the principal's commitment.

In their study of contractual relationships between Kenyan flower exporters and their international clients, Macchiavello and Morjaria (2015) provide evidence consistent with this prediction. First, they estimate (lower bounds of) the value of these contractual relationships by computing the revenues foregone by flower exporters when delivering a batch to a client at the stipulated price rather than selling it on the spot market. Because contracts are in fact informal due to the low quality of Kenyan courts, self-enforcement requires that the value of the relationship be at least as large as the exporter's temptation to sell on the spot market. Second, Macchiavello and Morjaria (2015) show that the estimated lower bound of the contractual relationship for a given seller-client pair increases over time as the relationship grows older.

While the evidence in Macchiavello and Morjaria (2015) is consistent with Halac's (2012) prediction, their model differs from Halac (2012) in that it assumes symmetric uncertainty and learning about the seller's reliability, rather than asymmetric information, and as a result, it does not predict signaling, screening, or breach in equilibrium. It is therefore unclear whether the predictions unique to Halac (2012), on the relationship between contractual dynamics, prior beliefs at the beginning of the relationship, and the parties' relative bargaining power, could be tested using the dataset of Macchiavello and Morjaria (2015).

We will return on the potential empirical relevance of the Macchiavello and Morjaria (2015) dataset for testing non-standard models of informal contracting later on in this section.

3.2. Potential data sets to test Board (2011)

Ideally, to test Board's (2011) main predictions on a principal's propensity to switch agents one needs longitudinal data on the identity of a firm's contractual partners, and on whether these partners have been contracting with the firm before.

As Board (2011) points out, the ideal settings for testing this model are non-exclusive supply agreements (e.g., Asanuma 1989). To separate Board's theory from theories that yield similar predictions but do not involve informal contracts (for instance, those appealing to the differential skills of new agents versus "insiders"), one would also need to identify whether the contractual relationship is informal or not. As before, this could be done indirectly, by comparing institutional settings with strong or weak court enforcement.

There are several data sets used for other purposes that could shed light on the validity of Board's (2011) predictions. Here we discuss three of them in some detail. First, Gil and Marion (2013) use data on highway procurement auctions in California where contractors must choose a number of subcontractors when they submit their bids. Their analysis documents the existence of loyalty: all else equal, contractors are more likely to choose subcontractors with whom they have worked before. Their study does not examine loyalty as literally defined by Board (2011)—that is, as a contractor's preference for inefficient "insider" subcontractors over efficient but "outsider" ones. A variable that has been used in the literature to measure efficiency is distance of the subcontractor from the project location. Therefore, a more precise measure for loyalty here may be a contractor's propensity to choose a subcontractor with whom it has interacted before even when it is not the one located closest to the project. Gil and Marion (2013) also provide

an exogenous inverse measure for a contractor's and a subcontractor's intertemporal discount rate, which they proxy by the number and value of projects auctioned over the next calendar year.³ Hence, the data in Gil and Marion (2013) may be used to test the fourth testable prediction from Board's model—namely, on the positive relationship between loyalty and the discount rate.⁴

Second, the aforementioned study of Gil and Marion (2013), as well as the study of flower import-export in Kenya by Macchiavello and Morjaria (2015), may be used to test Board's predictions that the quality of suppliers' services should decrease after the buyer stops being loyal and brings in outside suppliers. This prediction could be indirectly tested using the data in Gil and Marion (2013). While those data do not include measures of the quality of subcontractors' services, they do provide longitudinal information on a contractor's profits and sales, which should be positively affected by the subcontractors' quality. Board's prediction may be more directly tested using the data in Macchiavello and Morjaria (2015), which include longitudinal information on the matching between flower exporters and importers, as well as on whether an exporter delivers a specific shipment of roses to its client on time. To test Board's prediction, one may look at whether an exporter's deliveries are less likely to be fulfilled on time after his client has introduced new exporters into his supply chain.

³ Since projects are offered when they are needed and not as a response to a particularly good match between contractor and subcontractor, this measure of the potential future value of the relationship is not contaminated by endogenous considerations of how well contractors and subcontractors are matched or were matched in the past.

⁴ Calzolari et al. (2014) use a data set of relationships between German carmakers and their input suppliers. Their data comes from a cross-sectional survey and it may contain questions that hint towards relationship strength and loyalty. Their data may also be used to test whether car makers in Germany are less likely to switch to new suppliers when these are located in countries characterized by of different legal system quality.

Finally, in order to mitigate the hold-up problem, such disloyal firms will try to introduce more complete contracts. Moszoro et al. (2014) use a large data set of publicly available contracts from the SEC's EDGAR database constructing variables that proxy contract length and rigidity. We may test this fourth implication by comparing firms that change partners often to those that are likely to stay with the same partner. This prediction would imply that the contracts of these two types of firms look very different in terms of length and rigidity, and they do even more so for projects where hold-up is more likely to occur.

3.3. Control variables and caveats

While the theoretical models in both Halac (2012) and Board (2011) deliver sharp predictions on informal contracting under asymmetric information and liquidity constraints, some of those predictions may be also delivered by models of formal contracts or by more conventional models of informal contracts. In this section, we briefly discuss what empirical controls would be needed to distinguish Board's and Halac's predictions from those of competing models.

A first caveat, discussed in section 2.2, pertains to Board's (2011) prediction that the degree of loyalty should decrease in the extent of formal contracting (for instance, as measured by court quality). This prediction is unique to Board's model under the assumption that information is complete irrespective of whether suppliers are insiders or outsiders. If the buyer's information on outside suppliers (for instance, on their financial situation or honesty) were instead incomplete, the buyer might be more concerned about contracting with outsiders than with insiders—that is, loyalty may arise in equilibrium. Moreover, the buyer's loyalty might increase as formal contracts become harder to

enforce, because absent formal contracts, the buyer would have fewer safeguards against the outside suppliers' default or dishonest behavior.

Hence, the tests of Board's prediction that we suggest above would be stronger and more reliable if one could control for the buyer's information on suppliers. As we suggested in discussing the testability of Halac's model, public information on a company's reliability may be provided by official rankings and other reputational measures, such as credit ratings, as well as by ownership cross-holdings and membership into a business association (Ahmadjian and Oxley 2006, 2013; Johnson et al. 2002).

Finally, most of Board's (2011) predictions may no longer be unique if there were a systematic difference between the supplies a buyer procures from insiders and outsiders. For instance, suppose a buyer procures one product from supplier A exclusively (say, because A has unique skills), whereas he is considering to switch to cheaper outside supplier B for a second product. If the contracts between the buyer and his suppliers are informal, the buyer may choose to be loyal to A because if he reneges on A he stands to lose more, as A supplies him with two products, whereas B would only supply him with one product. In other words, enforcing multi-product informal contracts may be easier, as suggested by Bernheim and Whinston (1990) and Levin (2002). Hence, empirical tests of Board's model would be stronger if one could control for the scope of a buyer's contractual relationships with insiders, relative to outsiders.

4. Testing other non-standard models of informal contracting

In this last section, we briefly describe two additional non-standard informal contracting models, and we discuss their potential testability. As we discuss below, these models offer predictions on important dimensions of firm organization, such as cooperation cycles and informal delegation, which are not studied in Halac (2012) and Board (2011). At the same time, these models seem to impose a tougher data collection burden on empirical researchers. That is why our discussion of testability here is mostly tentative.

4.1. Li and Matouschek (2013)

Like Halac (2012), Li and Matouschek (2013) modify the informational structure of the standard informal contracting model. The difference is that, while Halac (2012) assumes the principal has private information on his type, Li and Matouschek (2013) assume the principal has private information on his cost of paying the agent. Their model is thus well suited to analyze conflicts that arise when the principal fails to pay a bonus despite observing high effort, and the agent cannot tell whether this is due to the principal's unforeseen financial problems or to renegeing (see Fast and Berg 1975 and Stewart 1993 for anecdotal evidence that these conflicts occur in employment relationship).

If the agent is to be motivated by the promise of an informal bonus, the principal's failure to pay such a bonus must be punished, so unlike in the standard model, surplus destruction occurs in equilibrium in Li and Matouschek (2013). More specifically, they

show that under an optimal informal contract: (1) the relationship is characterized by indefinitely alternating cycles of cooperation and punishment; (2) punishment cycles are “smooth”, in the sense that effort and surplus decrease gradually after the principal’s privately observed shock, whereas cooperation cycles are “steep”, in the sense that effort and surplus revert to the efficient level as soon as the principal starts honoring bonus payments again; and finally, (3) the relationship does not terminate in equilibrium.⁵

To (indirectly) test predictions (1) and (2) in Li and Matouschek (2013), one would need data on effort or output in an employment relationship, or in a supply or distribution relationship, over a long time horizon.⁶ In addition, one would need to control for product and business cycles in order to fully support Li and Matouschek’s (2013) informal contracting explanation for cyclic performance. There are a few studies that use effort-level data in employment relationships (see Mas and Moretti 2009 on Safeway cashiers, and Bandiera et al. 2005, and related papers, on fruit-picking). Several measures of output have been proposed in buyer-supplier relationships and procurement, such as trade credit levels (Johnson et al. 2002), delays and cancellations in air transportation (Forbes and Lederman 2009), contractors’ ability to bid low in auctions (Gil and Marion 2013), and exporters’ timely deliveries to importers (Macchiavello and Morjaria 2015).

A more direct test could be performed by running a survey of contractual relationships that are at least in part informal and collecting data on how deviations are punished. As discussed before, one may be able to classify a contractual relationship as informal by relying on company records (Gil 2013) or by looking at contracts that are

⁵ Other models of informal agreements that predict cycles of cooperation and punishment are Green and Porter (1984), Yared (2010), Englmaier and Segal (2014), and Contreras (2015).

⁶ As Li and Matouschek (2013) recognize, prediction (2) on the slope of cycles is sensitive to their assumption that the production function is concave.

subject to mandatory disclosure (Gillan et al. 2009) or occur in countries with weak court enforcement (Johnson et al. 2002, Antras and Foley 2014).

4.2. Li, Matouschek and Powell (2014)

Li et al. (2014) use an informal contracting model where the agent has private information about a decision-relevant state to study power dynamics in organizations—that is, how power is earned, lost and retained by individuals or groups within organizations. The authors note that informal incentives in organizations are often provided by a promise of empowerment rather than by money, so it is important to understand how informal power dynamics are designed to make informal incentive contracts self-enforcing. As in Green and Porter (1984) and Li and Matouschek (2013), optimal informal contracts entail equilibrium punishments in Li et al. (2014). Unlike in those models, though, power delegation (empowerment) does not cycle back and forth between principal and agent, and either ends in permanent centralization or permanent empowerment. Sadly enough, whether the organization ends in one or the other steady state is fully determined by random events that occur during the organization's history.

Li et al. (2014) also find that under an informal empowerment contract, and in contrast with learning-based models, an organization's ability to adapt to changes in the environment gets *worse* over time: as a result of past empowerment promises, the agent may end up being fully and permanently empowered, and thus he may cease to choose projects that are in the best interest of the principal.

Their final prediction is that these power dynamics in organizations may partly explain the observed large and persistent differences across seemingly similar enterprises

(Gibbons and Henderson 2013), and why mature firms may have a harder time adapting to changes in their environments than younger rivals. These differences in performance may arise across industries and firms even when copying strategies and organizational practices of successful rivals is possible.

Corporate governance is a context where the predictions from Li et al. (2014) may be tested. By now, there is evidence that entrenched (staggered) boards are associated with a reduction in firm value (Bebchuk and Cohen, 2005). The question is whether, as predicted by Li et al. (2014), these companies are also less likely to adapt to changes in the industry. To test for that, we would need to empirically observe whether besides being less valuable, companies with entrenched boards are also associated with especially large losses in value when an industry shakeout occurs or upon entry of new competitors.

Finally, what makes Li et al. (2014) a difficult paper to test is that its underlying mechanisms rely heavily on factors that are hard to observe. First, the number and type of projects available to managers is usually unobservable to the econometrician (in the same way that it is unobservable to the principal in their model) and therefore, it is difficult to verify when, why and how a manager may be abusing her power by choosing a project that is not in the best interest of the shareholders. Second, power within organizations is difficult to quantify. Hence, an empirical study testing whether the mechanisms underneath the negative relationship between board entrenchment and firm performance conforms to the model in Li et al. (2014), should follow firms and managers over time and quantify the concentration of power through hierarchical control decision authority, and the like. While this may be possible (e.g., Guadalupe et al., 2014), it does impose a heavy data collection burden on the empirical researcher.

5. Conclusion

In this paper we have discussed the testability of recent theoretical models of informal contracting, which study relationships characterized by incomplete information and imperfect ability to share rents. In such environments, informal contracts change over time in ways that respond to the parties' attempts to maximize rent-extraction (Board 2011), resolve informational asymmetries (Halac 2012), and punish imperfectly monitored deviations (Li and Matouschek 2013).

While a body of empirical evidence on these “non-standard” models does not exist yet, testing them seems important, as they have implications for fundamental managerial choices like the dynamic structure of informal incentives in employment (Halac 2012, Li and Matouschek 2013) and the degree of turnover in supply chains (Board 2011). To contribute to fill this gap between theory and evidence, we have suggested possible tests of the non-standard models, which could be performed using existing data on employment relationships, as well as supply and distribution chains. We hope our paper will foster future empirical research that will expand our understanding of this new frontier in informal contracting theory, and help us to push the frontier even further.

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